3.0 Systemwide Conditions

This section provides an overview of existing and future systemwide conditions in the SPFC and Systemwide Planning Areas. More detailed information can be found in the plan-related and reference documents listed in Section 2.4.

3.1 Existing Systemwide Conditions

The following subsections present information on, or references to, reports with information on existing environmental, physical, social, economic, and policy and institutional conditions. This section is based primarily on existing and available information. Information on existing systemwide conditions will be updated as relevant technical data are developed for future updates of the CVFPP.

3.1.1 Existing Environmental Conditions

Three documents attached to the 2012 CVFPP were used to discuss the existing environmental conditions in the Systemwide Planning Area:

- The most detailed description of the ecological environment and biological conditions in the Systemwide Planning Area is in the PEIR (DWR, 2012). Topics discussed include aesthetics, air quality, aquatic and terrestrial biological resources, geology, soils, and seismicity, groundwater resources, hazards and hazardous materials, hydrology, land use and planning, noise, public services, recreation, transportation and traffic, utilities and service systems, and water quality.

- The RCR (DWR, 2010b) also discusses biological conditions (terrestrial and aquatic resources), social and economic conditions, cultural resources, institutional, emergency planning, response, and recovery.

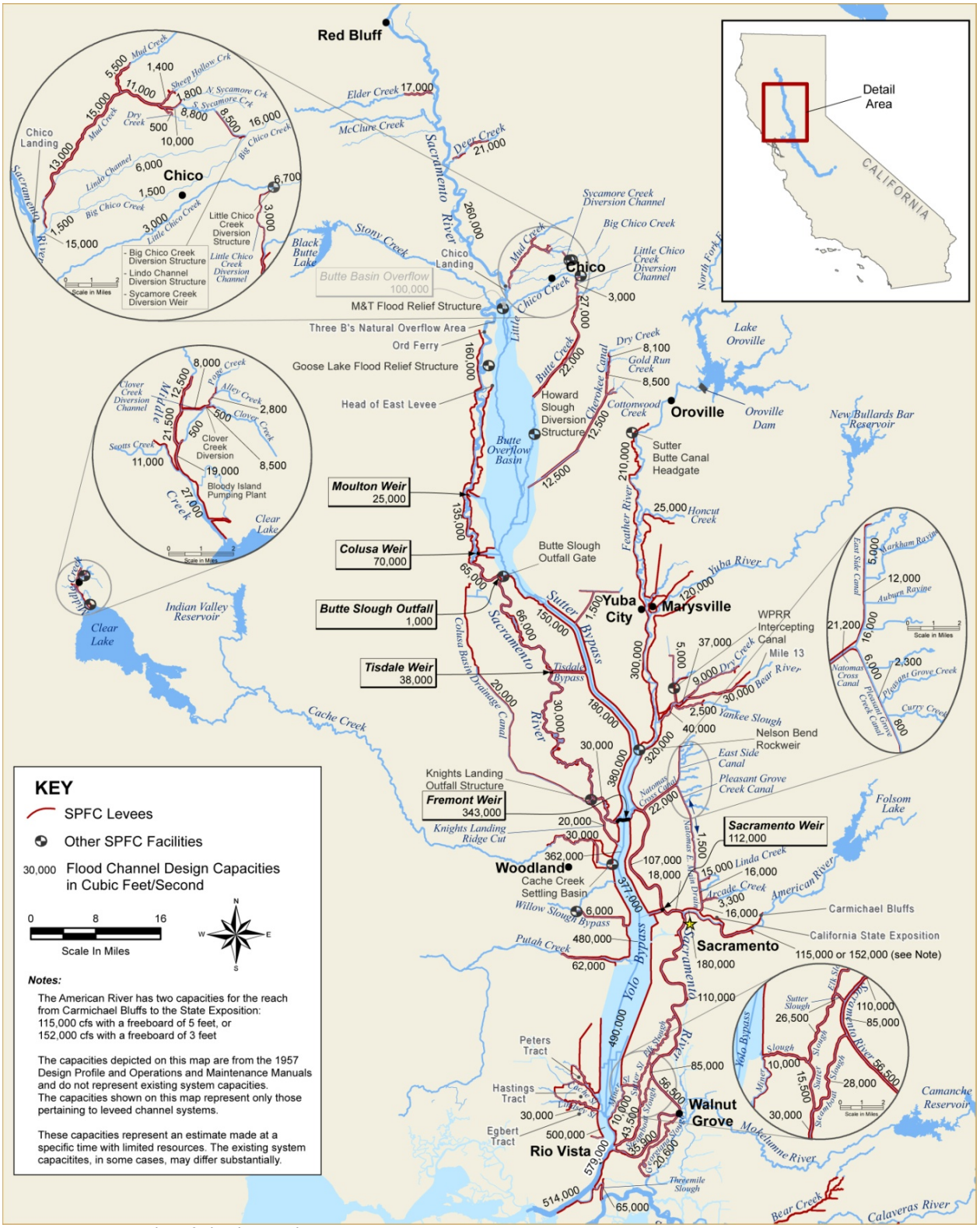
- Floodway ecosystem conditions are discussed in further detail in the Attachment 2: Conservation Framework. Topics discussed include river flow and hydrologic processes; geomorphic processes and channel and floodplain dynamics; and riparian and riverine habitats and species, invasive species, and fish passage barriers.

3.1.2 Existing Physical Conditions

The primary focus of the 2012 CVFPP is to reduce flood risk and promote integrated flood management for areas protected by the SPFC facilities illustrated in Figures 3-1 and 3-2, and described in Table 3-1.

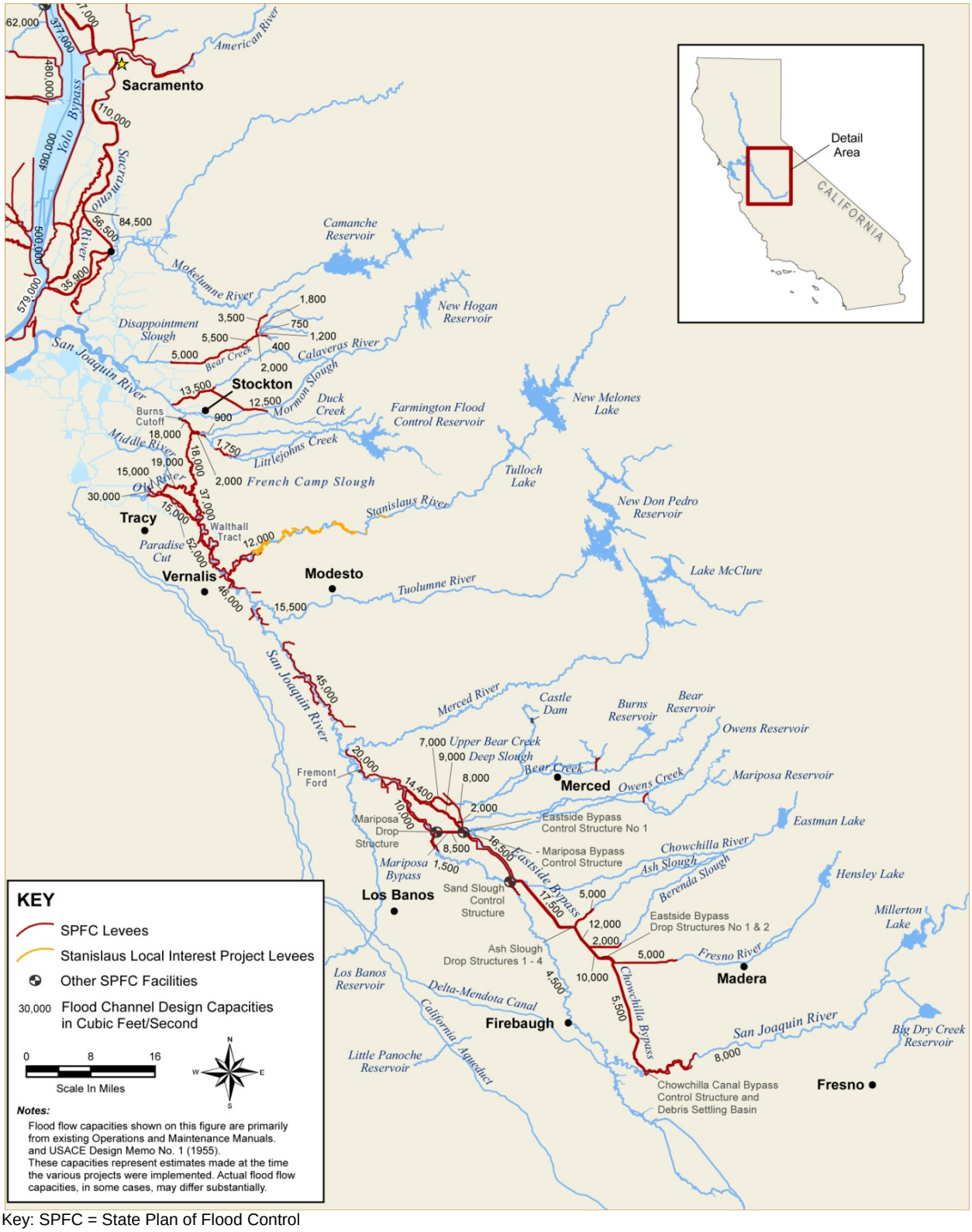
The SPFC flood management system evolved over time through an incremental construction process driven by periodic flood disasters, and the need to maintain navigable channels, reclaim lands for agricultural use, and support population growth and development in the Central Valley.

SPFC facilities have been added over time through the individual and combined efforts of State, federal, and local agencies. These features were constructed with varying design standards and construction techniques, and do not provide a consistent level of flood protection throughout the system. Despite efforts to manage floods through building and upgrading facilities, changes in land use in areas protected by the SPFC, including urban development in floodplains and a shift to higher value permanent agriculture, have increased consequences of flooding over time.



Key: SPFC = State Plan of Flood Control

Figure 3-1. State Plan of Flood Control Facilities, Sacramento River Basin



Key: SPFC = State Plan of Flood Control

Figure 3-2. State Plan of Flood Control Facilities, San Joaquin River Basin

Table 3-1. Overview of State Plan of Flood Control

Feature and Description
Project Works:
• Approximately 1,600 miles of levees • Two flood relief structures and one natural overflow area spilling floodwaters from the Sacramento River into the Butte Basin • Four fixed weirs (Moulton, Colusa, Tisdale, Fremont) and one operable weir (Sacramento) spilling floodwaters from the Sacramento River into the Butte Basin, Sutter Bypass, and Yolo Bypass • Four dams (North Fork Feather River Diversion, Oroville Dam, Cache Creek Settling Basin, Castle Dam) • Five control structures directing flow in bypass channels along the San Joaquin River • Seven major pumping plants • Channels • Bypasses and sediment basins • Environmental mitigation areas • Associated facilities, such as bank protection, stream gages, and drainage facilities
Lands:
• Fee title, easements, and land-use agreements • Approximately 18,000 parcels
Operations and Maintenance:
• Two standard operations and maintenance manuals • 118 unit-specific operations and maintenance manuals • Maintenance by State and local maintaining agencies
Conditions:
• Assurances of Cooperation (as specified in Memorandums of Agreement, the California Water Code, and agreements) • Flood Control Regulations, Section 208.10, 33 Code of Federal Regulations • Requirements of standard and unit-specific operations and maintenance manuals • Design profiles (1955 and 1957)
Programs and Plans:
• Historical documents and processes • As-constructed drawings • Oversight and management • Ongoing programs and plans

Key:
State = State of California

Current Status of State Plan of Flood Control Facilities

Today, much of the legacy Central Valley flood management system is characterized by aging infrastructure, built over many years, often using outdated standards and techniques. In addition, the system is subject to different hydrologic and climate conditions at the present time than when the facilities were originally constructed. Society's expectations for flood system performance that also supports other benefits, such as ecosystem

function, are also different today than when the SPFC facilities were originally constructed.

Although the SPFC has prevented billions of dollars in flood damages since facilities were originally constructed, some SFPC facilities face a high chance for failure when evaluated against modern engineering and safety criteria (DWR, 2011). The general condition of urban levees, nonurban levees, and channels of the SPFC are presented in Figure 3-3 and summarized below:

- Approximately half of about 300 miles of SPFC urban levees evaluated do not meet current engineering criteria.

- Approximately three-fifths of about 1,200 miles of SPFC nonurban levees evaluated have a high relative potential for failure from under-seepage, through-levee seepage, structural instability, and/or erosion.

- Approximately half of the 1,016 miles of channels evaluated in the SPFC have inadequate capacities to convey design flows; these channels require additional evaluation to confirm conditions.

- None of the 32 hydraulic structures or 11 pumping plants inspected by DWR for the SPFC were rated Unacceptable during the 2009 inspections; however, many are approaching the end of their design lives and need replacement, or at least, major rehabilitation. Of the 10 SPFC bridges inspected by DWR in 2009, 2 were in need of repairs.

  The most detailed description of existing conditions for flood management facilities in the SPFC Planning Area are in the State Plan of Flood Control Descriptive Document (DWR, 2010a) and FCSSR (DWR, 2011a).

The SPFC represents a portion of the Central Valley flood management system for which the State has special responsibilities, as defined in the California Water Code. It is defined as follows (CPRC 5096.805(j)):

> *The state and federal flood control works, lands, programs, plans, conditions, and mode of maintenance and operations of the Sacramento River Flood Control Project described in Section 8350 of the Water Code, and of flood control projects in the Sacramento River and San Joaquin River watersheds authorized pursuant to Article 2 (commencing with Section 12648) of Chapter 2 of Part 6 of Division 6 of the Water Code for which the board or the department has provided the assurances of nonfederal cooperation to the United States.*

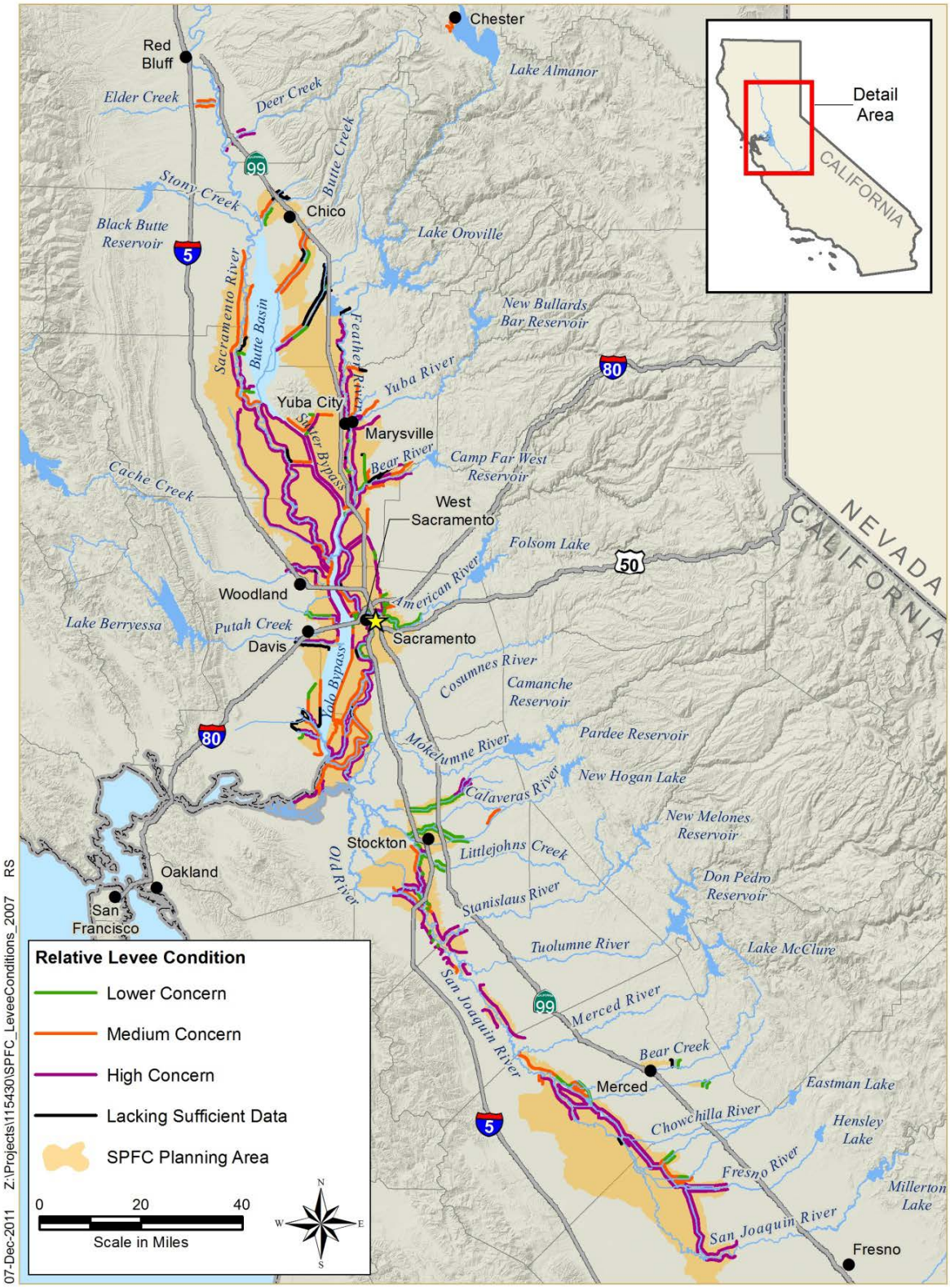


Figure 3-3. Summary of Physical Levee Conditions Based on Levee Evaluations Program Results

- The State Plan of Flood Control Descriptive Document (DWR, 2010a) includes detailed descriptions of SPFC works or facilities, SPFC lands, SPFC O&M, SPFC conditions, and programs and plans related to the SPFC. Existing physical conditions are described in Sections 2, 3, and 4. The document also includes a less detailed description of non-SPFC works or facilities that affect SPFC O&M as part of the larger flood management system.

- The FCSSR (DWR, 2011a) presents the current status, or physical condition of SPFC levees, channels, and flood control structures, and limited information on non-SPFC facilities. Adverse physical conditions identified in the FCSSR are used as a basis for defining flood and related resources problems for the 2012 CVFPP, and are discussed in Section 4.

3.1.3 Multipurpose Reservoirs and Designated Floodways

State Assurances of Cooperation to the Federal Government

- *Not given for most multipurpose reservoirs in the Central Valley because no direct State operational responsibility.*
- *Not given for designated floodways because they are a condition of project operation for the SPFC.*

There are numerous multipurpose reservoirs and designated floodways that are important to flood management in the Central Valley. The State has not provided assurances of cooperation to the federal government for most of the multipurpose dams (except Oroville Dam) or designated floodways, so they are not considered SPFC facilities.

Where implemented, the Board's Designated Floodway Program helps limit further development into active floodways. Although not considered SPFC facilities, designated floodways are an important management tool to help the State meet its requirement for passing project design flows and are therefore a condition of project operation for the SPFC. For more information on how designated floodways are part of the SPFC, see Section 6.8 of the State Plan of Flood Control Descriptive Document (DWR, 2010a).

Figure 3-4 provides an overview of multipurpose reservoirs within the Sacramento and San Joaquin river basins that include flood management as one of the purposes. Additional details concerning the reservoirs are summarized in Table 3-2. An overview of designated floodway locations is shown in Figure 3-5.

3.1.4 Assets Protected by the State Plan of Flood Control

Over the last century, the Central Valley has experienced intensive development to meet the needs of a growing population. A complex water supply and flood risk management system supports and protects a vibrant agricultural economy, several cities, and numerous small communities. The SPFC protects a population of more than 1 million people, major freeways, railroads, airports, water supply systems, utilities, and other infrastructure of statewide importance, including more than $70 billion in assets (includes structural and content value, and estimated annual crop production values) (Figure 3-6). Many of the more than 500 species of native plants and wildlife found in the Central Valley rely to some extent on habitat existing within the SPFC Planning Area.

Figure 3-4. Multipurpose Reservoirs Within Sacramento and San Joaquin River Basins

Table 3-2. Multipurpose Reservoir Project Summary

Reservoir	Dam	Year Completed	Total Reservoir Capacity (TAF)	Flood Storage Capacity (TAF)	Owner/Operator
Sacramento River Basin					
Shasta Lake	Shasta Dam	1949	4,552	1,300	Reclamation
Black Butte Lake	Black Butte Dam	1963	144	136	USACE
Folsom Lake	Folsom Dam	1956	975	670[2]	Reclamation
Lake Oroville	Oroville Dam[1]	1967	3,538	750	DWR
New Bullards Bar Reservoir	New Bullards Bar Dam	1967	970	170	Yuba County Water Agency
Indian Valley Reservoir	Indian Valley Dam	1976	301	40	Yolo County Flood Control and Water Conservation District
San Joaquin River Basin					
Millerton Lake	Friant Dam	1949	521	170[3]	Reclamation
Lake McClure	New Exchequer Dam	1967	1,025	350	Merced Irrigation District
New Don Pedro Reservoir	New Don Pedro Dam	1970	2,030	340	Turlock Irrigation District
Hensley Lake	Hidden Dam	1975	90	65	USACE
H.V. Eastman Lake	Buchanan Dam	1975	151	45	USACE
New Melones Lake	New Melones Dam	1978	2,420	450	Reclamation
Los Banos Detention Reservoir	Los Banos Dam	1965	35	14	Reclamation/DWR
Pardee Reservoir	Pardee Dam	1963	210	200[4]	East Bay Municipal Utilities District
Camanche Reservoir	Camanche Dam	1963	431		
New Hogan Reservoir	New Hogan Dam	1964	317	152	USACE

Source: USACE, 1997

Notes:

[1] Oroville Dam is part of the SPFC, as is the smaller single-purpose Castle Dam in the San Joaquin River Basin. All other dams in this table are non-SPFC.

[2] Folsom Dam is operated with variable flood storage between 400,000 acre-feet and 670,000 acre-feet to take credit for seasonally available storage in upstream reservoirs.

[3] Friant Dam is operated in conjunction with Mammoth Pool and upstream reservoirs.

[4] Camanche Dam is operated in conjunction with Pardee Dam and upstream reservoirs.

Key:

DWR = California Department of Water Resources
Reclamation = U.S. Department of the Interior, Bureau of Reclamation
SPFC = State Plan of Flood Control
TAF = Thousand acre-feet
USACE = U.S. Army Corps of Engineers

Figure 3-5. Designated Floodways Within Sacramento and San Joaquin River Basins

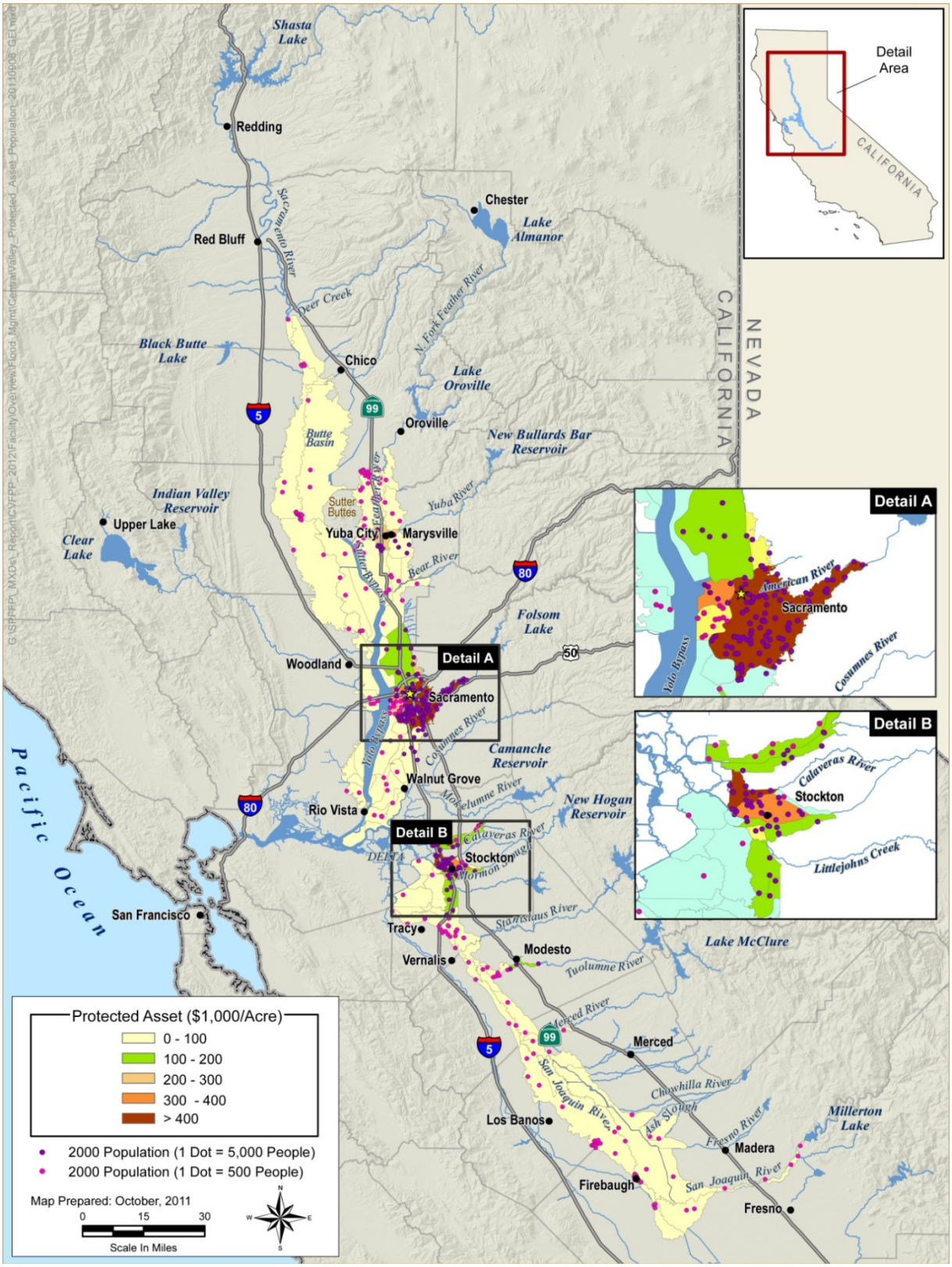


Figure 3-6. Geographic Distribution of Assets Protected by State Plan of Flood Control Facilities

3.1.5 Existing Social and Economic Conditions

Detailed descriptions of existing social and economic conditions in the planning area are summarized in the Attachment 8: Technical Analysis Summary Report:

- **Attachment 8F: Flood Damage Analysis** – Expected annual damages are calculated using the USACE Hydraulic Engineering Center (HEC)-Flood Damage Assessment (FDA) model to analyze direct tangible flood damages to structures, businesses, and crops, and indirect tangible costs related to emergency response and recovery.

- **Attachment 8G: Life Risk Analysis** – Analyzes life risk as a qualitative indicator of flood risk using a HEC-FDA modeling approach.

- **Attachment 8H: Regional Economic Analysis** – Estimates the effects of proposed flood management improvements on regional economic activity, specifically employment (jobs) and output (dollars).

- **Attachment 8I: Benefit Assessment** – Describes benefit categories associated with proposed flood management improvements in the 2012 CVFPP.

Topics in the attachments include building cost per square foot; estimate of structure and content value, crop damage values; estimate of emergency costs; life safety as an indicator of flood risk; comparison of conditions analyzed and their respective life safety values; population and household income; employment and economic output by industry, employment, State and local tax revenue; regional economic impact analysis; and economic benefit evaluation framework.

3.1.6 Existing Policy and Institutional Conditions

Detailed descriptions of policy and institutional conditions in the Systemwide Planning Area are presented in the RCR (DWR, 2010b). Topics include laws and regulations, governance structures and responsibilities, funding, and coordination. Further description of existing policy and institutional conditions are contained in the Descriptive Document, Sections 5, 6, and 7, for O&M, conditions (terms), and programs and plans related to the SPFC.

3.2 Likely Future Systemwide Conditions

Defining existing conditions and how these conditions may change in the future is critical to the planning process. The magnitude of change influences not only the scope of problems and opportunities, but the extent of related conditions that could be affected by possible actions taken to address them. This section briefly describes the period of analysis for the 2012 CVFPP, key drivers and influencers for integrated flood management, and likely future conditions.

For the 2012 CVFPP, the period of analysis is through 2050. The period of analysis is the time frame for which plan effects are evaluated and likely changes in conditions are considered. All plan elements were analyzed using this period of analysis. It should be noted that project life for many plan elements may be longer than the period of analysis. Further, it may not be possible to project or anticipate all changes over the period of analysis.

Key drivers and influencing factors associated with integrated flood management define likely future conditions and challenges. Drivers are trends and external forces outside the control of flood managers that impact integrated flood management. Drivers and influencers for integrated flood management in the Central Valley include the following:

- Change in population, and type and location of development in floodplains
- Water supply reliability and conveyance needs
- Climate change
- Environmental regulations
- Water quality
- Availability of public funding for flood management system improvements
- Legislative mandates to increase levels of flood protection in urban and urbanizing areas

For more detailed information on these drivers and influencers, see the RCR (DWR, 2010b).

Predicting future changes to the physical, biological, social, and economic environments is complicated by various flood management, ecosystem

restoration, water supply reliability, and water quality efforts that are anticipated to be implemented over the period of analysis (through 2050). It is difficult to estimate how these individual projects may influence future conditions because they are not part of a well-defined, integrated, or regional plan. Furthermore, these efforts may not meet the conditions generally required for projects to be considered reasonably foreseeable (i.e., authorized, funded, and permitted, or under construction). Following is a brief description of likely changes in future conditions.

3.2.1 Likely Future Environmental Conditions

Basic conditions in the physical environment are expected to remain relatively unchanged in the future. No significant changes to area topography, bathymetry, soils, or geology are foreseen. Continued development in urban and suburban areas is expected.

Without physical changes to the river basins, hydrologic conditions will probably also remain unchanged. The region's hydrology could be altered should there be significant changes in global climatic conditions. Without changes in hydrology, topography, or geology, sedimentation and erosion patterns are also likely to remain unchanged.

Increased population is one factor that could degrade water quality, but existing regulations require mitigation for that effect. Increased ecosystem restoration (i.e., restored wetlands) would provide some improvement in water quality. In addition, efforts are underway to better manage the quality of runoff from urban environments to stream systems, and to control the levels and types of herbicides, fungicides, and pesticides that can be used in the environment.

As the population continues to grow, a general degradation of air quality conditions could occur. However, because of technological innovation and increasingly stringent regulations, air quality could improve over time.

Ongoing restoration efforts along rivers are expected to marginally improve natural riparian habitat, riverine processes, and rivers' abilities to meander. Restoring floodplain processes will also provide some flood protection by increasing groundwater recharge. Without levee realignments or new offstream storage or bypasses, the geomorphology of the Sacramento and San Joaquin river basins would remain similar to present conditions.

Efforts are underway by numerous agencies and groups to restore various biological conditions throughout the Sacramento and San Joaquin river basins. Accordingly, areas of wildlife habitat, including wetlands and riparian vegetation areas, are expected to be protected and restored. While regional habitat planning initiatives exist, most habitat improvement will be

based on separate opportunities that are not integrated in a single plan. Therefore, ongoing restoration will likely provide localized benefits.

Through ongoing efforts of various agencies and groups, populations of special-status species in riverine and nearby areas are estimated to generally remain constant. Although increases in anadromous and resident fish populations could occur through implementing various ongoing restoration projects, some degradation will likely occur through actions that reduce flows or elevate water temperatures.

3.2.2 Likely Future Physical Conditions

Urban development within floodplains will increase the need for improved flood management. Urban development adjacent to existing flood management facilities will limit options and opportunities for facilities improvement in urban areas. The cost and time necessary to conduct routine facility maintenance or reconstruct or improve existing facilities will affect implementation of those efforts. Compliance with existing environmental regulations will continue to constrain maintenance activities and affect decisions on where and when new flood management facilities can be constructed, pending funding availability.

3.2.3 Likely Future Social and Economic Conditions

The population of California is estimated to increase from about 37 million to more than 60 million by 2050 (DOF, 2007). Growth in population may contribute to the conversion of agricultural and other rural land to urban uses, particularly in the Central Valley. This will increase flood risk and further reduce land available for maintaining and restoring ecosystem values.

Anticipated increases in population growth in the Central Valley will also increase demands on water resources systems for additional and reliable water and energy supplies; water-related, recreational, and flood management facilities; water and wastewater utilities; public services such as fire, police protection, and emergency services; and communication infrastructure. Modification of existing traffic corridors and construction of new transportation routes will likely occur, further connecting anticipated population growth centers in the Central Valley. Anticipated increases in population will also have impacts on visual resources as areas of open space are converted to urban uses.

3.2.4 Likely Future Policy and Institutional Conditions

Flood management in the Central Valley rests on a complex institutional landscape. Laws and regulations exist at multiple levels (State, federal, and local), and are evolving. Changing laws and regulations will need to be considered for future plans and projects.

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4.0 Flood and Related Resource Problems

As discussed in the Regional Conditions Report – A Working Document (DWR, 2010b), the landscape of the Central Valley and its drainage area has changed dramatically since the flood management system was initially built because of urban expansion, agricultural intensification, changes in societal values, and changes in land cover in the valley and upper watershed source areas. From these and other changes, problems have developed related to flood risk management and related resource conditions. This section describes flood-management-related problems that are addressed through the 2012 CVFPP.

In the context of this section, a "problem" is an undesirable condition – something that is currently viewed as "broken" or will likely be so in the future. Problems provide a common focal point or reason for people to join together in a planning process. As part of the outreach process for the 2012 CVFPP, problems were initially identified from the input of State, federal, regional, local, and tribal interests. Many of these interested parties participated in planning area work groups and/or topic work groups convened to help articulate existing resource conditions for the 2012 CVFPP; problem identification was an important output of those meetings. In this manner, the outreach process helped DWR identify potential environmental, physical, economic and demographic, and policy and institutional problems. Concurrently with the outreach process, environmental problems were clarified through the CVFPP PEIR, and physical problems were clarified through the FCSSR.

As mentioned, problems are the common ground that motivates collective participation in a planning process – the reason for undertaking the effort. As such, problems were instrumental in helping participants shape broad goals and specific objectives for the 2012 CVFPP, and were crucial building blocks for identifying, developing, and screening potential management actions and solutions. These initial solutions and management actions were captured and advanced for consideration in the next phase in the 2012 CVFPP development process, which is preliminary approach development.

4.1 Environmental Problems

Identified Flood Risks & Related Problems

Ecosystems – The construction, operations, and maintenance of the existing flood management system have also contributed to declining conditions and trends for biological resources within the flood management system. This includes the loss, degradation, and fragmentation of natural aquatic and terrestrial habitat; declines in species populations and constraints on species movement; increases in stressors on these habitats and species; and disruption in the hydrologic, geomorphic, and ecological processes upon which their habitats and species depend.

This section briefly describes environmental problems in the Systemwide Planning Area. For more detail, see the PEIR and Attachment 9B: Status and Trends of the Riparian and Riverine Ecosystems of the Systemwide Planning Area.

Much of the Central Valley levee system was built over many years using whatever sands, silts, clays, and soils, including organic soils that were conveniently available, often poorly compacted over inadequate foundations. Due to limited data, estimates of storm magnitudes, and, thus, flood storage and conveyance requirements, have been consistently low. System capacity issues are further exacerbated by the impacts (such as increased variability) of global climate change. This evolving system of levees, bypasses, dams, and pumps was originally constructed to foster economic development and promote public safety. However, with declining environmental quality due to many causes, the remaining high-quality riparian habitat along the Central Valley's leveed streams has taken on greater importance for the preservation of salmon (*Oncorhynchus*), steelhead (*Oncorhynchus mykiss*), sturgeon (*Acipenser*), Swainson's hawks (*Buteo swainsoni*), bank swallows (*Riparia riparia*), giant garter snakes (*Thamnophis gigas*), and many other threatened or endangered species. Environmental quality has become an increasingly important consideration in the design, construction, operations, and maintenance of the flood management system.

In many parts of the Sacramento and San Joaquin river basins, dynamic, geomorphic and biological processes are severely compromised. The historical practice of constructing SPFC levees close to the river channels to induce sediment scour has, in many cases, interfered with the natural stream meandering process. Riverine habitats and ecosystem functions have been degraded over time through changes in land use, construction of dams and levees, water pollution, and other causes.

As a result, the geographic extent, quality, and connectivity of native habitats along Central Valley rivers have all declined so that the system can no longer support sustainable populations of many species. Today, less than 4 percent of the historical riparian forests that lined valley streams remain, with a significant portion of this forest growing on, or close to, levees of the SPFC.

4.2 Physical Problems

Physical problems affecting performance of SPFC facilities are described in detail in the FCSSR (DWR, 2011a). Although the SPFC has prevented billions of dollars in flood damages since construction, some SFPC facilities face an unacceptably high chance of failure. In addition, an unintended consequence of the long-term effort to construct and upgrade SPFC facilities and the multipurpose reservoir system is that flood damages have increased over time due to development in levee-protected areas. That is, although the chance and frequency of flooding are decreased, the damages that occur when flooding does occur are much greater, resulting in a net long-term increase in cumulative damages.

The overall condition of urban levees, nonurban levees, channels, and flood control structures of the SPFC are presented in Figure 4-1 and can be summarized as follows:

- **Urban levees** – Approximately half of about 300 miles[8] of SPFC urban levees evaluated do not meet current levee freeboard, stability, or seepage design criteria[9] at the design water surface elevation.

- **Nonurban levees** – Approximately three-fifths of about 1,200 miles of SPFC nonurban levees evaluated have a high potential for failure from under-seepage, through-seepage, structural instability, and/or erosion at the assessment water surface elevation.[10] Nonurban levees were evaluated based on systematic, consistent, repeatable analyses that correlated geotechnical data with levee performance history, not relative to any current design criteria.[11]

- **SPFC channels** – Approximately half of the 1,016 miles of channels evaluated in the SPFC have a potentially inadequate capacity to convey design flows, and require additional evaluation to confirm conditions.

Identified Flood Risks & Related Problems

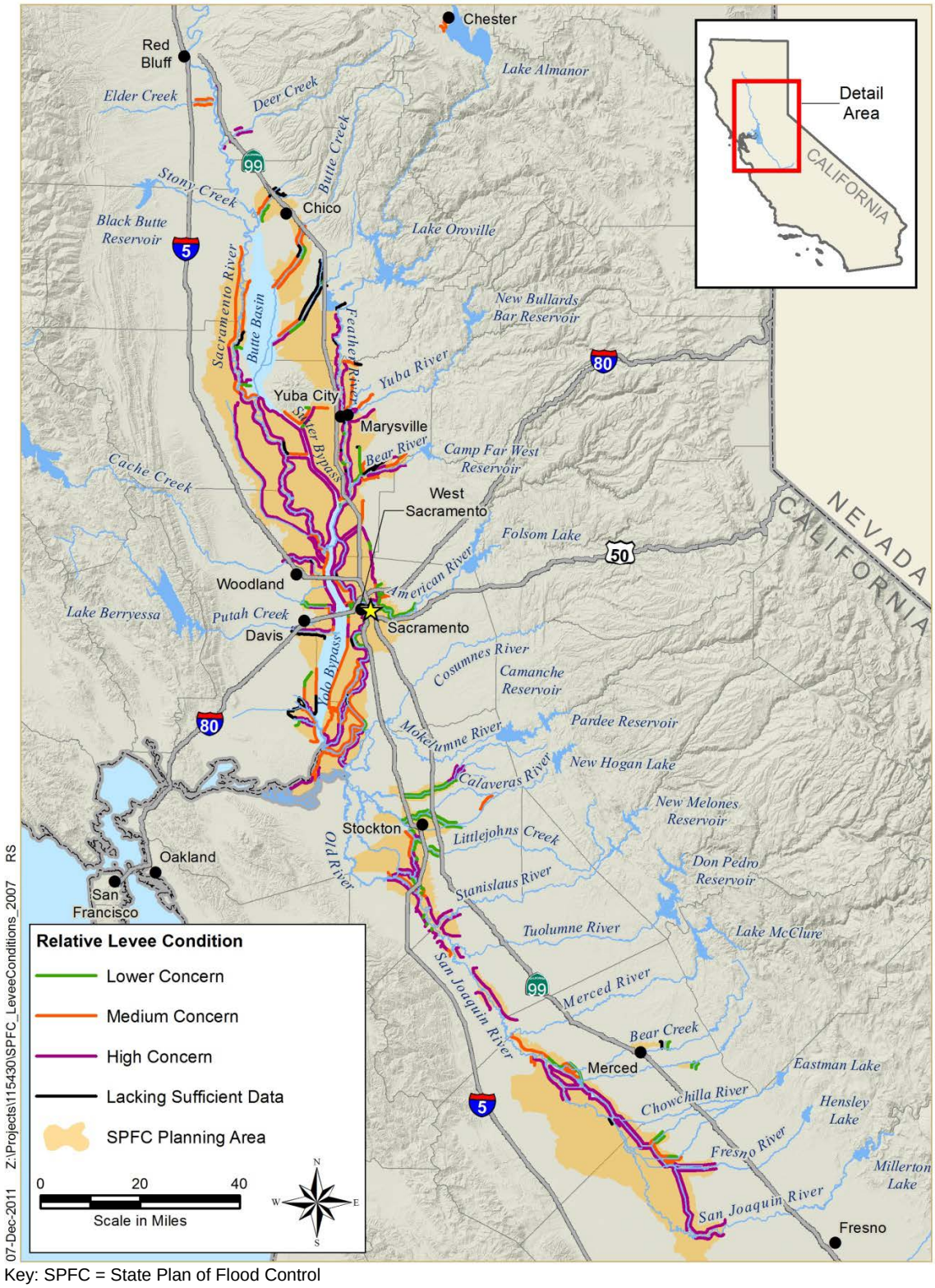
Operations & Maintenance – O&M (including significant repairs) of the flood management systems in the Sacramento and San Joaquin river basins is difficult and often deferred because of limitations from original system design; prevalent system encroachments; inconsistent standards and practices; complex, time-consuming, and at times conflicting permitting and mitigation requirements, and lack of reliable funding sources and financial instruments.

[8] Additional 10 miles of SPFC urban levees are being evaluated, and results will be included in future updates.

[9] The design criteria used were based on the USACE 2000 *Design and Construction of Levees Engineering Manual 1110-2-1913,* and DWR 2010 *Interim Levee Design Criteria for Urban and Urbanizing Areas in the Sacramento Valley, Version 4*.

[10] Where available, 1955/57 design water surface elevations were used as the assessment water surface elevation. In the absence of 1955/57 design water surface elevations, the assessment water surface elevation was based on freeboard requirements for each levee segment (i.e., generally 3 feet below the levee crest).

[11] This approach was selected because the extent of the NULE Project is significantly greater than the ULE Project, making it difficult to conduct the same level of field explorations and geotechnical data collection performed for ULE levees.



Key: SPFC = State Plan of Flood Control

Figure 4-1. Summary of Physical Levee Conditions Based on Levee Evaluations Program Results

- **SPFC flood control structures** – None of the 32 hydraulic structures or 11 pumping plants inspected by DWR for the SPFC were rated Unacceptable during the 2009 inspections. Of the 10 SPFC bridges inspected by DWR in 2009, 2 were in need of repairs.

O&M and repairs of the flood management system are difficult to execute and often deferred for many reasons. These include the original system design deficiencies; inadequate funding; encroachments; inconsistent levee maintenance practices among maintaining agencies; and complex, time-consuming, and conflicting permitting and mitigation requirements.

Table 4-1 lists factors that influence facility performance, findings related to each factor, and the relative threat posed by the factor.

Table 4-1. Flood Control System Status Report Findings

	Factors	Findings	Relative Threat Posed by Factor[1]
Levees	**Overall Levee Condition (multiple factors)**	• Approximately half of SPFC urban levees do not meet current levee freeboard, stability, or seepage design criteria at the design water surface elevation. • Approximately three-fifths of SPFC nonurban levees have a high potential for levee failure from under-seepage, through-seepage, structural instability, and/or erosion at the assessment water surface elevation.	See Figure ES-2
	Levee Geometry Check	• Approximately one-third of SPFC urban levees deviate from current standard levee design prism criteria. • Levee geometry deviates significantly from the standard levee design prism criteria for some nonurban SPFC levees.	Medium
	Seepage	• Approximately one-third of urban levees do not meet current seepage design criteria. • Almost half of SPFC nonurban levees have a high potential for levee failure from under-seepage. • Approximately one-quarter of SPFC nonurban levees have a high potential for levee failure from through-seepage.	High
	Structural Instability	• Approximately one-fifth of SPFC urban levees do not meet current structural stability design criteria. • Approximately one-seventh of SPFC nonurban levees evaluated in the Sacramento River watershed and 1 percent in the San Joaquin River watershed have a high potential for levee failure from structural instability.	Medium
	Erosion	• Erosion assessments for urban levees are underway, and results are not available at this time. • Almost one-sixth of SPFC nonurban levees have a high potential for levee failure from erosion.	Medium
	Settlement	• Four known localized levee locations have settlement (localized depressions) that endangers the integrity of SPFC levees.	Low
	Penetrations[2]	• More than 6,000 penetration sites are documented in SPFC levees, and many more remain undocumented.	Medium

Table 4-1. Flood Control System Status Report Findings (contd.)

	Factors	Findings	Relative Threat Posed by Factor[1]
	Levee Vegetation	• About 15 miles of SPFC levees are noncompliant with DWR 2007 *Interim Levee Vegetation Criteria.*[3] [5]	Low
	Rodent Damage	• More than one-third of the 1,459 miles of SPFC levees studied had at least eight reported occurrences of burrowing activity over a 21-year study span.	Medium
	Encroachments[4]	• 1,223 encroachment sites were identified as partially or completely obstructing visibility and access to the levee and/or within 10 feet of the landside toe.[5]	Medium
Channels	**Inadequate Conveyance Capacity**	• Approximately half of the 1,016 miles of SPFC channels evaluated are potentially inadequate to convey design flows, and require additional evaluation to confirm conditions. • Approximately one-quarter of channel design capacities reported in O&M manuals do not agree with flows specified in the design profiles.	Medium
	Channel Vegetation	• Of 186 miles of SPFC channels inspected by DWR, one location was rated Unacceptable and 54 locations were rated Minimally Acceptable because of vegetation and obstructions.[5]	Low
Structures	**Channel Sedimentation**	• Of 186 miles of SPFC channels inspected by DWR, 1 location was rated Unacceptable and 23 locations were rated Minimally Acceptable because of shoaling/sedimentation.[5]	Low
	Inadequate Hydraulic Structures	• Of 32 SPFC hydraulic structures inspected by DWR, no structures were rated Unacceptable because of structural, vegetation/obstruction, encroachment, or erosion/sedimentation	Low
	Inadequate Pumping Plants	• Of 11 SPFC pumping plants inspected by DWR, none were rated Unacceptable.[5]	Low
	Inadequate Bridges	• Of 10 SPFC bridges inspected by DWR, 2 were in need of repairs.[5]	Low

Notes:
[1] The relative threats listed in Table 4-1 were generated based on professional experience of technical staff from DWR and partner agencies.
[2] Penetrations include man-made objects that cross through or under a levee or floodwall and have the potential to provide a preferential seepage path or hydraulic connection with the waterside. Typically, a penetration is a pipe or transportation structure, such as a roadway or rail line.
[3] This finding is based on DWR 2007 *Interim Levee Vegetation Criteria* and not on USACE levee vegetation criteria. Comparison with USACE levee vegetation criteria would show more SPFC levees as noncompliant.
[4] Encroachments are any obstruction or physical intrusion by construction of works or devices, planting or removal of vegetation, or caused by any other means, for any purpose, into a flood control project, waterway area of the flood control project, or area covered by an adopted plan of flood control (California Code of Regulations Title 23 Chapter 1 Article 2 Section 4 (m)). Encroachments include boat docks, ramps, bridges, sand and gravel mining, placement of fill, fences, retaining walls, pump stations, residential structures, and irrigation and landscaping materials/facilities.
[5] Inspection results reported are from DWR's 2009 Inspections.

Key:
DWR = California Department of Water Resources
O&M = operations and maintenance
SPFC = State Plan of Flood Control
USACE = U.S. Army Corps of Engineers

The findings in Table 4-1 are relative to DWR's current criteria for use in the 2012 CVFPP. In most cases, these criteria are identical, or very similar to, USACE criteria. However, differences between DWR and USACE levee vegetation criteria are significant enough that comparison of levees with USACE criteria would likely show more SPFC levees as noncompliant with current USACE criteria. Accordingly, using USACE criteria for vegetation on levees would likely result in a finding of more SPFC levees receiving lower inspection ratings than presented in the FCSSR. DWR and USACE continue to work to resolve these differences.

4.3 Social and Economic Problems

As discussed in previous sections, the Sacramento and San Joaquin river basins have been subject to flooding and increased flood risk to people and property because of physical and operational constraints of the existing flood management system, increasing use of facilities for multiple purposes beyond the original intent of the system, and changing land uses and increased population in flood-prone areas stemming from limited understanding of flood risk.

Population increase and distribution will likely drive changes in land-use patterns, potentially increasing the population at risk from flooding and possibly further reducing existing agricultural land and wildlife habitat. Continued urban development within major floodplains will also make future changes to the footprint of the flood management system progressively more costly, and increase consequences and risks (life safety and damages) when the flood management system is overwhelmed.

Climate change is expected to generate more extreme floods, a greater fraction of seasonal precipitation as rain rather than snow, and rising sea levels. These trends appear to be already well established and, if they continue as expected, they will put increasing stress on California's flood management system. Floodplain risk assessments and development constraints will likely be adjusted accordingly. For example, the 1 percent and 0.5 percent annual chance flood events, calculated based on historical flood events, will become larger for many watersheds, with long-term effects on National Flood Insurance Program map ratings, flood insurance costs, floodplain development, and the economic viability of floodplain communities. In addition, as the moderating effects of snowpack on runoff decrease, there will be a need for both greater flood control storage and water supply storage, putting greater pressure on California's multipurpose

Identified Flood Risks & Related Problems

Risks & Consequences of Flooding– The Sacramento and San Joaquin River basins have been subject to flooding and increased flood risk to people and property due to physical and operational constraints of the existing flood management systems, increasing use of facilities for multiple purposes beyond the original intent, and changing land uses in flood-prone areas stemming from limited understanding of flood risk. Flood risk is likely to continue to increase in some areas of the river basins because of climate change.

flood control reservoirs. Increased temperatures and altered runoff patterns also directly impact the health of California's natural ecosystems and habitats.

Although flooding along the Sacramento and San Joaquin rivers and their major tributaries is a natural process, flooding poses significant risks to human life, health, and safety. Social and economic problems are defined in the 2012 CVFPP Supporting Documentation, Technical Documentation, Attachment 8F: Flood Damage Analysis, Attachment 8G: Life Risk Analysis, and Attachment 8H: Regional Economic Analysis.

4.4 Policy and Institutional Problems

Identified Flood Risks & Related Problems

Policy & Institutional – Responsibilities and roles for flood management in the Sacramento and San Joaquin river basins are dispersed among many agencies with varying functions and priorities.

Responsibilities for flood management and land-use decisions in the Sacramento-San Joaquin Valley are dispersed among many agencies. The development, maintenance, and improvement of the State's flood management system, as well as land-use planning, are all related. Land-use decisions, such as those involving development in floodplains, are typically made at the local level by counties and cities. Local jurisdictions often have economic incentives to support and encourage such development. On the other hand, when levees fail, resulting in flood damages and loss of life, the costs associated with floodfighting, rescue, recovery, and rehabilitation are shared by local, State, and federal agencies.

Dispersal of these responsibilities across many local, regional, State, and federal agencies can lead to policies, funding practices and mechanisms, and institutional arrangements that do not support effective flood management and land-use planning.

Overlapping jurisdictions across various federal and State agencies involved in flood management can lead to inconsistent policies and regulations. Coordinating activities within this fragmented jurisdictional landscape can be challenging, particularly for local entities.

Policy and institutional problems were identified through the outreach process and through the SPFC Descriptive Document (Section 6) (DWR, 2010a). Contributing factors related to policy and institutional problems and their relevance to each of the 5 planning regions discussed in Section 2 can be summarizes as follows:

- Flood management is often made difficult by large number of agencies and entities involved because of the following for all regions:

  - Complex jurisdictional roles and responsibilities
  - Conflicting policies, missions, and priorities
  - Conflicting regulations and legislation
  - Lack of coordination (planning and implementation)
- Land-use decisions at local level may not adequately consider flood risk because of the following:
  - Poor or outdated flood risk information and maps for all regions
  - Strong desire for economic development for parts of all regions
- Land-use practices can affect flood management because of the following for parts of all regions:
  - Rapid urbanization
  - Agricultural land practices
- There is a trend toward strict liability for damages due to flood control facility failure that deters construction and effective management of flood management projects for all regions
- Current State, federal, and local funding mechanisms are not adequate to sustain effective flood management because of the following for all regions:
  - Inability to assess and generate funding at a local level
  - Limitations on State funding
  - Declining federal cost share
  - Federal benefit/cost requirements

Note that the list above is subjective based on the 2012 CVFPP outreach process, and are not meant to be scientifically precise or imply that technical or scientific documentation about the condition is necessarily available. In some instances, although problems listed above may have been previously been experienced in some regions and have since been resolved, concerns remain over the problem potentially recurring in the future.

Identified Flood Risks & Related Problems

Integrated Water Management – The flood management systems within the Sacramento and San Joaquin river basins rely on physical hydrologic features, infrastructure, and institutional arrangements that affect other components of water resources management. Flood management requirements often make it difficult to meet other water resource needs.

4.5 Integrated Water Management

The flood management systems within the Sacramento and San Joaquin river basins rely on physical hydrologic features, infrastructure, and institutional arrangements that affect other components of water resources management. Flood management requirements often make it difficult to meet other water resources needs. DWR is currently promoting the concept of integrated regional water management (IRWM). IRWM planning is the way in which DWR hopes to achieve sustainable water uses, reliable water supplies, better water quality, environmental stewardship, efficient urban development, protection of agriculture, a strong economy, and improved flood management. Based on the 2012 CVFPP outreach process, IRWM is being made difficult by competing needs for flood protection, water supply, ecosystem resources, recreation, water quality, hydropower, and dam safety in all regions.

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